IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Hirokazu Yamagata et al. Art Unit : 1762
Serial No. : 09/852,090 Examiner : Michael Cleveland
Filed : May 10, 2001
Title : A METHOD OF MANUFACTURING A LIGHT EMITTING DEVICE

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Commissioner for Patents
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BRIEF ON APPEAL

(1) Real Party in Interest

Semiconductor Energy Laboratory Co., Ltd., the assignee of this application, is the real party in interest.

(2) Related Appeals and Interferences

There are no related appeals or interferences.

(3) Status of Claims

Claims 5, 6, 18, 19, 23, 24, 28, 29, 33 and 34 are pending in the application, and claims 1-4, 7-17, 20-22, 25-27, 30-32 and 35-102 have been canceled.

(4) Status of Amendments

The claims were not amended after the final rejection of January 6, 2005.

(5) Summary of Claimed Subject Matter

The claims are directed to techniques for improving the white luminescence of an EL element. In particular, the inventors determined that white luminescence is detrimentally affected by poor continuity in the interface between different luminous layers (see page 3, lines 3-9). The inventors then determined that an excellent white luminescence could be obtained by forming the red and green luminescent layers such that they contact each other in a region having extremely high continuity (see page 3, line 27 to page 4, line 1). The excellent white luminescence characteristic of a device including layers formed in this manner is shown in the

graph of FIG. 1. In view of this, the inventors determined that it is desirable to form adjacent luminous layers in a continuous process without stopping the evaporation of the luminous material that is included in both of the layers. In particular, the present inventors determined that is was desirable to continue the evaporation of the luminous material even when stopping or starting the evaporation of the dopant (see page 4, lines 7-14)

In view of these conclusions, independent claim 5 recites a method of manufacturing an active matrix light emitting device that includes forming a red luminous layer comprising a first luminous material and a dopant over a substrate by evaporation; forming a green luminous layer comprising the first luminous material over the red luminous layer by stopping the evaporation of the dopant while continuing the evaporation of the first luminous material; forming a blue luminous layer comprising a second luminous material to be overlapped with the red luminous layer and the green luminous layer; and forming a hole injection layer comprising a conductive polymer. Claim 5 further recites that white light is obtained by a mixture of red light, green light and blue light emitted from the red luminous layer, the green luminous layer and the blue luminous layer, respectively.

Independent claim 6 recites a similar method that differs by forming the green luminous layer before the red luminous layer. In particular, claim 6 recites forming a green luminous layer comprising a first luminous material over a substrate by evaporation, and forming a red luminous layer over the green luminous layer comprising the first luminous material and a dopant by evaporating the dopant while continuing the evaporation of the first luminous material.

(6) Grounds of Rejection

Claims 5, 6, 18, 19, 23 and 24 have been rejected as being obvious over Eida (U.S. Patent No. 5,869,929) in view of Kobori (U.S. Patent No. 6,285,039); claims 28 and 29 have been rejected as being unpatentable over Eida in view of Kobori and Singh (U.S. Patent No. 6,228,228); and claims 33 and 34 have been rejected as being unpatentable over Eida in view of Kobori and Yamada (U.S. Patent No. 6,215,462).

(7) Argument

Appellant requests reversal of the rejection of claim 6 and its dependent claims because neither Eida, Kobori, nor any proper combination of the two describes or suggests forming a green luminous layer comprising a first luminous material over a substrate by evaporation; forming a red luminous layer over the green luminous layer comprising the first luminous material and a dopant by evaporating the dopant while continuing the evaporation of the first luminous material; and forming a blue luminous layer comprising a second luminous material to be overlapped with the red luminous layer and the green luminous layer, as recited in claim 6.

The rejection asserts that Eida describes every aspect of claim 6 except the formation of the red luminous layer by evaporating a dopant while continuing the evaporation of the first luminous material. Appellant respectfully disagrees. For example, Eida nowhere describes or suggests forming a red luminous layer over the green luminous layer, as recited in claim 6, and the rejection provides no indication as to where formation of a red luminous layer at this location is shown.

As best understood, the rejection seems to indicate that Eida shows this arrangement in the passage discussing an emitting layer for emitting white light at col. 18, lines 27-52. That passage describes several examples of such emitting layers, with the one that most closely corresponds to the claimed subject matter being example 5, which references Japanese Patent Application Laid-open No. 207170/1994 (the Japanese '170 application) as describing "[a]n emitting layer in which a blue light emitting layer ... and a green light emitting layer are laminated, further comprising a red fluorescent layer ... ." However, that passage makes no mention of forming a red luminous layer over a green luminous layer in the manner recited in the claim or otherwise, and, in addition, the Japanese '170 application, as best understood, describes an arrangement in which the red light emitting material is mixed into one of the blue or green layers. Accordingly, Eida does not describe or suggest the arrangement of green and red layers recited in claim 6.

Indeed, the rejection concedes that Eida does not describe forming a red luminous layer by evaporating the dopant while continuing to evaporate the first luminous material. The rejection then argues that

> [o]ne of ordinary skill in the art would have understood that stopping and restarting the evaporation of the host organic material would necessarily have taken longer than merely continuing the evaporation, and that an increase in the time of production would necessarily have reduced the number of light-emitting devices manufactured per unit time (production rate). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have continued the evaporation of the host organic material while beginning the evaporation of the dopant in order to have minimized the process time, and therefore maximized the production rate.

Appellant disagrees with the premise upon which this conclusion is based, in that continuing evaporation would not necessarily have increased the production rate, and, accordingly, a desire to increase the production rate would not necessarily have led one of ordinary skill in the art to continue the evaporation of the first luminous material. For example, if a second chamber or region were available such that the red luminous layer of one device could be formed in parallel with the green luminous layer of another device, then continuing the evaporation to form the red luminous layer would actually decrease the production rate (i.e., by decreasing the frequency with which the green luminous layers could be formed). Accordingly, since continuing evaporation of the first luminous material would not necessarily have increased the production rate, and Eida provides no other indication that a red luminous layer may be formed by continuing evaporation, applicant submits that Eida does not describe or suggest this element of claim 6.

Kobori, which is cited as evidence of known techniques for producing red layers, does not remedy the noted failures of Eida. Accordingly, for at least these reasons, the rejection of claim 6 and its dependent claims should be reversed.

With respect to claim 5 and its dependent claims, appellant requests reversal of this rejection for reasons similar to those discussed above with respect to claim 6. In particular, neither Eida, Kobori, nor any proper combination of the two describes or suggests forming a green luminous layer over a red luminous layer, let alone doing so by forming a red luminous layer comprising a first luminous material and a dopant over a substrate by evaporation; forming a green luminous layer comprising the first luminous material over the red luminous layer by stopping the evaporation of the dopant while continuing the evaporation of the first luminous material; and forming a blue luminous layer comprising a second luminous material to be overlapped with the red luminous layer and the green luminous layer, as recited in claim 5.

Appellant requests reversal of the rejections of claims 28, 29, 33 and 34 because neither Singh nor Yamada remedies the failure of Eida and Kobori to describe or suggest the subject matter of the independent claims.

Accordingly, for at least these reasons, appellant requests reversal of the pending rejections.

A check for $1520 covering the brief fee of $500 and the extension of time fee of $1020 is enclosed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 10/26/05

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Appendix of Claims

1-4. (Canceled).

5. (Previously Presented) A method of manufacturing an active matrix light emitting device, comprising:

forming a red luminous layer comprising a first luminous material and a dopant over a substrate by evaporation;

forming a green luminous layer comprising the first luminous material over the red luminous layer by stopping the evaporation of the dopant while continuing the evaporation of the first luminous material;

forming a blue luminous layer comprising a second luminous material to be overlapped with the red luminous layer and the green luminous layer; and

forming a hole injection layer comprising a conductive polymer,

wherein white light is obtained by a mixture of red light, green light and blue light emitted from the red luminous layer, the green luminous layer and the blue luminous layer, respectively.

6. (Previously Presented) A method of manufacturing an active matrix light emitting device, comprising:

forming a green luminous layer comprising a first luminous material over a substrate by evaporation;

forming a red luminous layer over the green luminous layer comprising the first luminous material and a dopant by evaporating the dopant while continuing the evaporation of the first luminous material;

forming a blue luminous layer comprising a second luminous material to be overlapped with the red luminous layer and the green luminous layer; and

forming a hole injection layer comprising a conductive polymer,

wherein white light is obtained by a mixture of red light, green light and blue light emitted from the red luminous layer, the green luminous layer and the blue luminous layer, respectively.

7-17. (Canceled).

18. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 5, wherein the first luminous material is Alq_3 (tris-8-quinolilite-aluminum complex).

19. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 6, wherein the first luminous material is Alq_3 (tris-8-quinolilite-aluminum complex).

20-22. (Canceled).

23. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 5, wherein the dopant is an organic material by which fluorescence can be obtained.

24. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 6, wherein the dopant is an organic material by which fluorescence can be obtained.

25-27. (Canceled).

28. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 5, wherein the dopant is an organic material by which phosphorescence can be obtained.

29. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 6, wherein the dopant is an organic material by which phosphorescence can be obtained.

30-32. (Canceled).

33. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 5, wherein said active matrix light emitting device is incorporated into an electronic device selected form the group consisting of a video camera, a digital camera, a goggle type display, a car navigation system, a sound reproduction system, a notebook type personal computer, a game apparatus, a portable information terminal, and an image playback device.

34. (Previously Presented) A method of manufacturing an active matrix light emitting device according to claim 6, wherein said active matrix light emitting device is incorporated into an electronic device selected form the group consisting of a video camera, a digital camera, a goggle type display, a car navigation system, a sound reproduction system, a notebook type personal computer, a game apparatus, a portable information terminal, and an image playback device.

35-102. (Canceled).